CLAIMS

We claim:

1.   A method of generating a library of simulated-diffraction signals and hypothetical profiles of a periodic grating, said method comprising:

generating diffraction calculations for a plurality of blocks of hypothetical layers,

wherein each block of hypothetical layers includes two or more hypothetical layers, and

wherein each hypothetical layer characterizes a layer within a hypothetical profile;

storing the diffraction calculations generated for the blocks of hypothetical layers;

generating a plurality of hypothetical profiles of the periodic grating;

generating simulated-diffraction signals of each hypothetical profile based on the stored diffraction calculations for the blocks of hypothetical layers; and

storing the plurality of hypothetical profiles and the simulated-diffraction signal for each hypothetical profile.

2.   The method of claim 1, wherein generating diffraction calculations comprises:

generating diffraction calculations for each hypothetical layer within each block of hypothetical layers; and

aggregating the diffraction calculations of the hypothetical layers within each block of hypothetical layers to generate the diffraction calculation for the block of hypothetical layers.

3.   The method of claim 1, wherein the blocks of hypothetical layers have trapezoidal shapes.

48

4.   The method of claim 1, wherein the hypothetical layers have rectangular shapes.

5.   The method of claim 1, wherein storing the diffraction calculations comprises:

storing the diffraction calculations within a cache.

6.   The method of claim 5, wherein the cache resides in a computer memory.

7.   The method of claim 1, wherein generating a plurality of hypothetical profiles comprises:

characterizing a hypothetical profile for the periodic grating with a set of parameters; and

varying the set of parameters to generate the plurality of hypothetical profiles.

8.   The method of claim 1, wherein generating simulated-diffraction signals comprises:

for each hypothetical profile,

selecting at least one block of hypothetical layers that characterizes the hypothetical profile;

retrieving the diffraction calculation associated with the selected block of hypothetical layers; and

applying boundary conditions to generate a simulated-diffraction signal for the hypothetical profile.

9.   The method of claim 8, wherein selecting at least one block of hypothetical layers comprises:

applying an error minimization algorithm to select one or more blocks of hypothetical layers to characterize the hypothetical profile.

10.   The method of claim 8, wherein selecting at least one block of hypothetical layers comprises:

selecting a first block of hypothetical layers that characterizes a first layer of the hypothetical profile; and

selecting at least a second block of hypothetical layers that characterizes at least a second layer of the hypothetical profile.

11.   The method of claim 10, wherein the first layer and at least the second layer of the hypothetical profile are formed from the same material.

12.   The method of claim 10, wherein the first layer of the hypothetical profile is formed from a first material and the second layer of the hypothetical profile is formed from a second material

13.   The method of claim 1, wherein storing the plurality of hypothetical profiles comprises:

pairing each hypothetical profile with the simulated-diffraction signal generated for that hypothetical profile, and

storing the hypothetical profile and simulated-diffraction signal pair.

14.   The method of claim 1, wherein the simulated-diffraction signals includes magnitude measurements.

15.   The method of claim 14, wherein the simulated-diffraction signals includes phase measurements.

16.   A method of generating a library of simulated-diffraction signals and hypothetical profiles of a periodic grating, said method comprising:

generating diffraction calculations for a plurality of blocks of hypothetical layers,

wherein each block of hypothetical layers includes two or more hypothetical layers;

storing the diffraction calculations generated for the blocks of hypothetical layers; and

generating simulated-diffraction signals for a plurality of hypothetical profiles of the periodic grating, wherein for each hypothetical profile:

at least one block of hypothetical layers is selected that characterizes the hypothetical profile,

the diffraction calculation associated with the selected block of hypothetical layers is retrieved,

a simulated-diffraction signal for the hypothetical profile is generated based on the retrieved diffraction calculation, and

the hypothetical profile and the generated simulated-diffraction signal are stored.

17.   The method of claim 16, wherein selecting at least one block of hypothetical layers comprises:

selecting a first block of hypothetical layers for a first hypothetical profile; and

selecting at least a second block of hypothetical layers for the first hypothetical profile.

18.   The method of claim 17, wherein the diffraction calculation associated with the first and second blocks of hypothetical layers are retrieved, and further comprising:

aggregating the diffraction calculations of the first and second blocks of hypothetical layers; and

applying boundary conditions to generate the simulated-diffraction signal for the first hypothetical profile.

19.   The method of claim 16, wherein the hypothetical profile includes a first layer formed from a first material and a second layer formed from a second material, and wherein selecting at least one block of hypothetical layers comprises:

selecting a first block of hypothetical layers for the first material that characterizes the first layer of the hypothetical profile; and

selecting a second block of hypothetical layers for the second material that characterizes the second layer of the hypothetical profile.

20.   The method of claim 16, wherein generating diffraction calculations comprises:

generating diffraction calculations for each hypothetical layer within each block of hypothetical layers; and

aggregating the diffraction calculations for the hypothetical layers within each block of hypothetical layers.

21.   The method of claim 16, wherein the diffraction calculations are generated and stored before generating simulated-diffraction signals.

22.   The method of claim 21, wherein the diffraction calculations are stored in a cache.

23.   The method of claim 22, wherein the hypothetical profile and generated simulated-diffraction signal are stored in a computer-readable medium.

24.   A method of generating a library of simulated-diffraction signals for a periodic grating, said method comprising:

generating diffraction calculations for a plurality of hypothetical layers;

forming a plurality of blocks of hypothetical layers,

wherein two or more hypothetical layers are grouped together to form each block of hypothetical layers, and

wherein for each block of hypothetical layers:

the diffraction calculations of the hypothetical layers within the block of hypothetical layers is aggregated to generate a diffraction calculation for the block of hypothetical layers;

storing the diffraction calculations generated for the blocks of hypothetical layers;

generating a plurality of hypothetical profiles of the periodic grating;

generating a simulated-diffraction signal for each hypothetical profile based on the stored diffraction calculations for the blocks of hypothetical layers; and

storing the generated simulated-diffraction signal.

25.   The method of claim 24, wherein the blocks of hypothetical layers have trapezoidal shapes of varying dimensions.

26.   The method of claim 25, wherein the hypothetical layers have rectangular shapes.

27.   The method of claim 24, wherein generating a plurality of hypothetical profiles comprises:

characterizing a hypothetical profile for the periodic grating with a set of parameters; and

varying the set of parameters to generate hypothetical profiles of varying shapes and dimensions.

28.   The method of claim 24, wherein generating simulated-diffraction signals comprises:

for each hypothetical profile,

selecting at least one block of hypothetical layers that characterizes the hypothetical profile;

retrieving the diffraction calculation associated with the selected block of hypothetical layers; and

generating the simulated-diffraction signals for the hypothetical profile based on the retrieved diffraction calculation.

29.   The method of claim 28, wherein selecting at least one block of hypothetical layers comprises:

selecting a plurality of blocks of hypothetical layers that characterize multiple layers within a hypothetical profile,

wherein the hypothetical profile can be formed from a single material or formed from two or more materials.

30.   A system for generating a library of simulated-diffraction signals for a periodic grating, said system comprising:

a processor configured to generate diffraction calculations for a plurality of blocks of hypothetical layers,

wherein each block of hypothetical layers includes two or more hypothetical layers;

a memory configured to store the diffraction calculations generated for the blocks of hypothetical layers; and

wherein the processor is further configured to:

generate simulated-diffraction signals for a set of hypothetical profiles of the periodic grating based on the diffraction calculations stored in the memory.

31.   The system of claim 30, wherein the processor comprises a plurality of processors.

32.   The system of claim 31, wherein the processor comprises:

a first processor configured to generate simulated-diffraction signals for a first wavelength; and

a second processor configured to generate simulated diffraction signals for a second wavelength.

33.   The system of claim 30, wherein for each hypothetical profile the processor is further configured to:

select at least one block of hypothetical layers from the memory that characterizes the hypothetical profile;

retrieve the diffraction calculation from the memory that is associated with the selected block of hypothetical layers;

apply boundary conditions to the retrieved diffraction calculation to generate the simulated-diffraction signal for the hypothetical profile; and

store the simulated-diffraction signal and the hypothetical profile.

34. The system of claim 33, wherein the processor is further configured to:

apply an error minimization algorithm to select the block of hypothetical layers.

35. The system of claim 30, wherein the processor is further configured to:

generate diffraction calculations for each hypothetical layer within each block of hypothetical layers; and

aggregate the diffraction calculations of the hypothetical layers within each block of hypothetical layers to generate the diffraction calculation for the block of hypothetical layers.

36. The system of claim 30, wherein the processor is further configured to:

generate and store the diffraction calculations for the blocks of hypothetical layers before generating the simulated-diffraction signals.

37. The system of claim 30, wherein the memory comprises a plurality of memories.

38. The system of claim 30, wherein the diffraction calculations stored in the memory is indexed by the shape and size of the blocks of hypothetical layers.

39. The system of claim 38, wherein blocks of hypothetical layers are generated for different types of materials used in forming the periodic grating, and wherein the diffraction calculations stored in the memory is indexed by material type.

40. A computer-readable storage medium containing computer executable instructions for causing a computer to generate a library of simulated-diffraction signals to be used in obtaining profiles of a periodic grating, comprising instructions for:

generating diffraction calculations for a plurality of hypothetical layers;

forming a plurality of blocks of hypothetical layers,

wherein two or more hypothetical layers are grouped together to form each block of hypothetical layers, and

wherein the diffraction calculations of the two or more hypothetical layers are aggregated together to generate a diffraction calculation for each block of hypothetical layers;

storing the diffraction calculations generated for the blocks of hypothetical layers;

generating a plurality of hypothetical profiles of the periodic grating; and

generating simulated-diffraction signals for each of the hypothetical profiles, further comprising:

selecting at least one block of hypothetical layers that characterizes the hypothetical profile,

retrieving the diffraction calculation associated with the selected block of hypothetical layers,

generating a simulated-diffraction signal for the hypothetical profile utilizing the retrieved diffraction calculation, and

storing the hypothetical profile and the generated simulated-diffraction signal.

41. The computer readable medium of claim 40, wherein the diffraction calculations for the blocks of hypothetical layers are stored in a cache.

57

42.   The computer readable medium of claim 40, wherein the diffraction calculations for the blocks of hypothetical layers are generated and stored before generating the simulated-diffraction signals for the hypothetical profiles.